

The Influence of Regulation and Disruptive Potential on the Entrants' Motivation and Ability within the Context of a Network Industry

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Abstract--This paper explores how regulation affects the motivation and ability of entrant firms to create successful new sub-markets that are shaped by a potential disruptive innovation. We focus on the telecommunication industry, particularly on the hotspot sub-market, to study these effects in the context of a network industry. In this setting, the impact of a potentially disruptive innovation might be different because of the institutional embeddedness of incumbent and entrant firms. We examine this phenomenon by analysing the entrants' strategies and success of market entry into the hotspot sub-market in 17 Western European countries. The results indicate that the sub-market success of entrants in regulated markets depends both on the regulation and the resistance of incumbents to regulation in a specific country. The findings from this paper further contribute to the general understanding of disruptive innovation, suggesting that regulation can be a more powerful force than the nature of the innovation itself on market outcomes. Finally, for Western Europe's telecommunication industry, our results show a predominately sustaining innovation character of WLAN used as public hotspots.

I. INTRODUCTION

The strategies and success of firms entering emerging sub-markets have been studied particularly from the perspective of the incumbent firms and in the context of the theory of disruptive innovation [6]; [8]; [10], [9]. Recent studies by Chesbrough [6] pointed to differences in the adaptation schemes by entrants and incumbents in different countries. In particular, the sub-market entry decision and subsequent disruption – seen as the replacement of incumbents – differs in its institutional framework compared to the country context ([5]; [6]. Anthony, Roth, and Christensen [2] and Christensen, Anthony, and Roth. [9] suggest that there are different regulative and institutional designs that enhance or diminish the chance of disruption. Competitive markets seem to be assumed here as “we believe the likelihood of disruption, the most dramatic form of innovation, increases substantially within competitive markets” [2]: p.1. However, they fail to support their proposition with large-scale empirical evidence from different regulative and institutional contexts on a multiple country basis. From a regulation perspective, researchers have concentrated on the differences in institutions or regulations per se. Their main focus is on finding differences in the regulative framework or theoretical concepts [14]; [28]. Typically, regulation sets barriers to entry and forces regulated firms to follow certain rules in order to eventually recreate competitive markets. The regulatory authority has an

oversight of market happenings, which leads to differences between the environments in different areas – usually on a country level – that are subject to their authorities. Anthony, Roth, & Christensen [2] found no disruption in telecommunications until it had been liberalized. Few researchers have concentrated on the success of entrants in the sub-markets and the factors residing at its roots. When it comes to combinations with regulation, most researchers have concentrated on the incumbents' behaviour. Therefore, the telecommunications industry and, in particular, the WLAN (Wireless Local Area Network) hotspot sub-market are ideal fields for researching the effects of regulation and institutional differences on the motivation and ability of entrants to create successful new sub-markets because the industry is subject to high country specific regulation forces from diverse national regulatory authorities. According to Chesbrough [6]: p. 660, a new “sub-market is created when a new technology offering causes one group of customers (some of whom may be new arrivals to that market) within an existing market to behave similarly to one another and differently from other customers in that market.” The emerging hotspot sub-market has been analyzed because this sub-market allows newly entering firms to enter the telecommunications market as a result of specific unconstrained regulation and a potential disruptive technology [12]; [17]. The new WLAN-entrants seemingly questioned the success of the mobile network operators' (MNOs) mobile data services and their huge investments into new network infrastructure or licences. Therefore, there is still an on-going discussion in both academic and business communities on the disruptive potential of WLAN – whether to view WLAN hotspots as sustaining or disruptive for the incumbents in the industry, i.e., the MNOs [9]; [17]; [20]; [25]; [31]. Consequently, this paper looks at the entrants in a new sub-market created by a potential disruptive technology such as WLAN in a cross-country and sector specific analysis in connection with regulation in 17 Western European countries.

The paper is structured as follows: First, the theoretical framework and hypotheses are developed based on the theory of disruptive innovation and extended by the motivation/ability framework with respect to regulation theory. Following this, our research setting – the WLAN hotspots sub-market – the sample, the operationalization of the variables as well as our methodology is described. Finally, we explain our results and conclude with implications.

II. THEORY AND HYPOTHESES DEVELOPMENT

A. The Disruptive Innovation Process and the Motivation/Ability Framework

Disruptive innovation theory classifies two kinds of innovations: disruptive and sustaining [8]; [9]. A sustaining innovation improves the existing trajectories and hence targets customers who haven't been satisfied by the antecedent technology. Disruptive innovations, on the other hand, are initially inferior in the performance metrics most demanded by mainstream customers and hence result in a break with the performance improvement. What Christensen and Christensen, Anthony, and Roth [8]; [9] depict is that, in the end, these disruptive innovations can replace the incumbents of the old markets.

The initial concept of disruptive innovations can be broken down into a process of disruption made up of eight comprehensible phases from invention to the incumbents' replacement [15]; [24]. The phases of the disruption process are shown in Figure 1. The first phase is represented by "invention," followed by "innovation" and "emerging, i.e. sub-market entry." In order to proceed into the next phase, i.e., the "entry into the main market," the sub-market must be developed and successfully established in advance. The next phase is represented by "customer attraction" in the main market and the "switching of the customers." An ineffective and late reaction by incumbents in a later phase, which is typical of the reactions to disruptive threats, leads to their

replacement in the final phase [7]; [16]; [24]. This framework is innovation-focused, and the subdivision helps to assess the potential threat of a disruptive change in advance, and improves the understanding of which phases have to be passed to finally lead to the incumbents' replacement. The phase perspective combines market specific, entrant specific, and incumbent specific factors. This subdivision helps to assess the potential threat of a disruptive change and improves the understanding of which phases have to be passed by an entrant in order to displace the incumbent.

Additionally, Christensen, Anthony, & Roth [9] extended the primary understanding of disruption by adding institutional settings that can diminish or enhance the chance of disruption, depending on the incentives and capabilities residing at the bottom of each market. These are influenced by both market and firm specific factors. Eventually, these factors have an influence on the entrants' and incumbents' performance in the market [9]. Therefore, the motivation/ability framework integrates the primary understanding of disruption by adding institutional differences that shape the competitive situation markets on an aggregate level [2]; [9]. The motivation dimension describes the incumbents' and entrants' willingness to innovate in a market. This willingness is determined by market factors such as market side influences and competition related factors. The ability dimension aggregates the entrants' and incumbents' capabilities in a market and includes factors that inhibit or enable innovating firms to pursue their goals in that

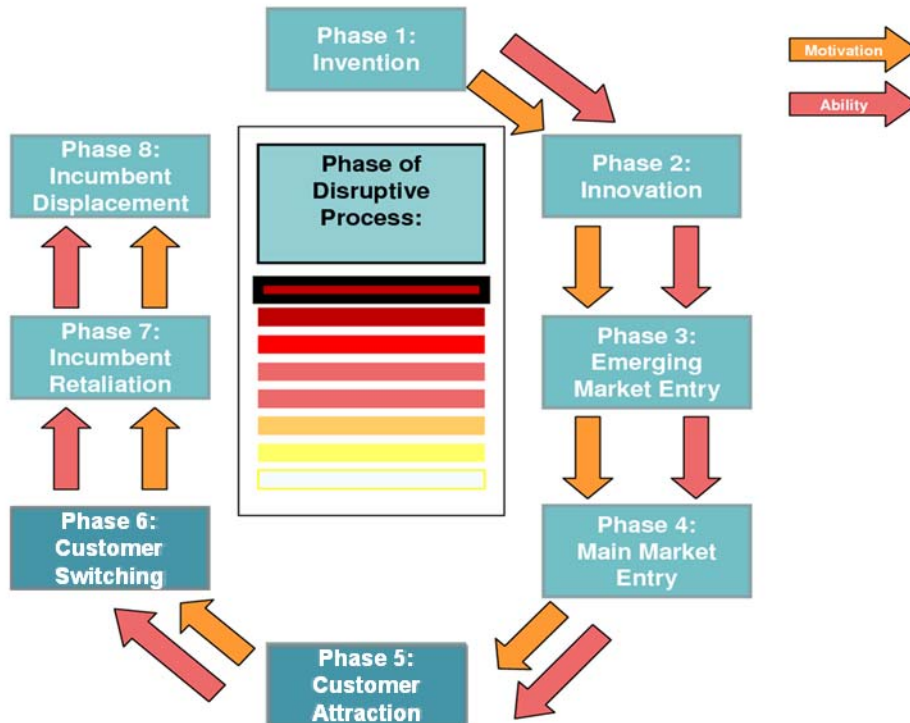


Figure 1: The phases of the disruption process and the motivation/ability framework [2]; [9]; [15]; [24]

market. They range from availability of resources, to the possibility of market entry, standards, and the general constitution of the industry. In the case of high motivation and ability in a given market, the resulting “hotbed” situation, as shown in Figure 2 will result in both market entries and success for entrants. In the “looking for a target” quadrant, entrants are motivated but not enabled by regulation. Being motivated then might lead to market entry, but the lack of ability results in failure. In the “looking for money” quadrant, entrants do not have the motivation but the ability to enter. This might cause the denial of market entry and failure in this market, too. The “dilemma” situation leads to denial and to failure [2]; [9]. Distortions from the extreme cases mentioned result in different grades of entry success, dependent on the relative degree of regulation. Figure 2 summarizes the outcomes of the different quadrants.

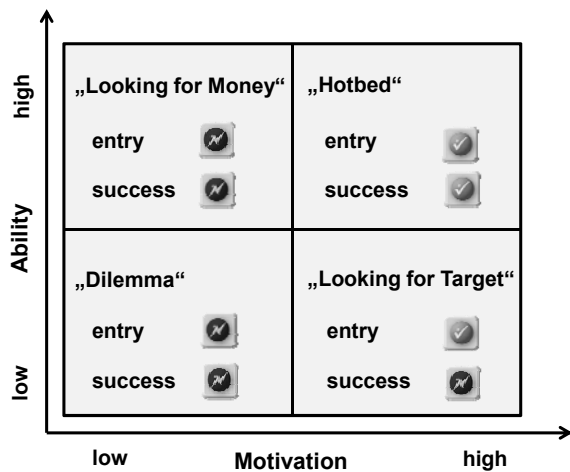


Figure 2: Prospective behavior and performance according to the motivation/ability framework [9]

Assuming that each innovation creates its own set of motivations and abilities, entrants or incumbents can be acting in different markets and different quadrants. With this extension, one can conclude that an entrant or an incumbent can reside in a “hotbed” situation in one market and in a “looking for a target” situation in another. Applying this framework to a potentially disruptive innovation, an entrant will find himself in a “dilemma” or “looking for money” situation, which results, in the end, in market entry denial. Rationally acting entrants will seek the best set of markets in order to maximize their benefits. The most distorting factor thereby is governmental regulation [2]; [9]. Therefore, regulation can influence the motivations and abilities residing in the different markets on a country-by-country level, which again has an influence on the incumbents’ and entrants’ market entry and success.

With the connection of both frameworks, it becomes evident that both entrants and incumbents need motivation and abilities in every phase of disruption to be a successful attacker or defender [2]; [15]; [24]. Figure 1 shows the importance of motivation as well as ability of both the

entrants and incumbents from the first to the last phase – the arrows can be seen as preconditions for the success of both entrants and incumbents.

B. Hypotheses Development based on an Extended Theoretical Framework

The following hypotheses were developed on the basis of the frameworks that are depicted in Figure 1 and 2, and reveal the entrants’ chances of succeeding in a regulated industry. In this sense, they particularly address stage three of the disruptive innovation process in Figure 1, in which it is decided whether entrants’ market sizes remain small and entrants only create small niche markets, or whether they can gain ample market sizes and create large markets, which, in the end, may disrupt the established incumbents [15]; [24]. The motivation/ability framework additionally shows that a combination of several influencing factors is decisive for successful growth [2]; [9]. Therefore, only the combination of the variables may lead to the entrants’ success.

In the following, we complement the above mentioned frameworks (see Figure 1 and 2) by drawing further attention to regulation theory. We then use these combined insights to develop our extended theoretical framework and to derive our hypotheses. Figure 3 shows this extended theoretical framework and the basic structure of our hypotheses (H1-3), which will be explained in detail in the following. This extended theoretical framework highlights the entrants’ behaviour with regard to the creation of different sized sub-markets that are influenced by regulation. A larger size of the resulting sub-market in a given country is seen as an indication of success by the entrants and as a high degree of disruptive potential of the underlying technology.

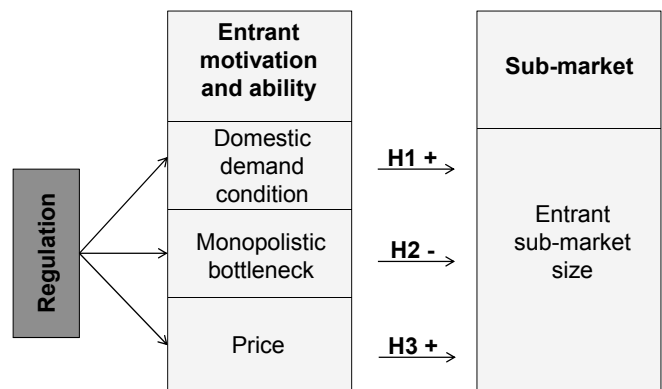


Figure 3: The extended theoretical framework to explain entrants’ behaviour with regard to the creation of different sized sub-markets that are influenced by regulation.

Governmental regulation is one of the main drivers in a market as it substantially changes motivation and ability [2]; [9]. Governmental regulation in our context means “the employment of legal instruments for the implementation of social-economic policy objectives” [14]: p. 223. A feature of legal instruments is that organizations can be forced by governments to comply with prescribed behavior under

penalty of sanctions. Firms can be forced, for example, to observe certain prices, to supply certain goods, to stay out of certain markets, to apply particular technologies in the production process or in products, or to pay the legal minimum wage. Sanctions can include fines, the publicizing of violations, imprisonment, an order to make specific arrangements, or the closing down of the business. The normative theory of regulation deals with reasons that can cause the need for regulations due to market failures [19]. These market failures can range from external effects, natural monopolies, public goods, sunk costs, ruinous price wars, universal service, interconnection, cross-subsidization, asymmetrical information, and important sectors [30]. Economies of scope, which occur in network industries such as in telecommunications, are another means of justification. If economies of scope exist, it is often more efficient if only one company produces the goods. This again justifies governmental intervention. The regulative instruments thereby are: barriers to market access, price regulation of the monopoly, and universal access. These above mentioned instruments cause the companies to act as if they were in a competitive market. Market access barriers should impede market entry, which could lead to ineffective entries. Low prices should protect customers from paying high prices, and universal access tries to mimic the case of many providers fighting for markets, which eventually leads to universal access [27]. Therefore, regulation can shape the competitive situation in a market. Incumbents and entrants in these markets adapt to the environments and react to these changed institutional settings. Regulation thereby shapes the motivations and the abilities in a market and thus changes entrants' and incumbent's behavior in a market [9].

Strong regulative efforts are typically connected with falling prices and the loss of market shares from former monopolists in connection with high penetration rates and higher quality products. The overall purpose of regulation is the creation of perfectly competitive markets. In such markets, customer penetration is high and the prices are low [4]. The motivation/ability framework, as highlighted in Section 2.1, describes the situation where entrants with disruptive innovations have the best possibilities and incentives for the creation of successful markets [9]. Using these insights of the motivation/ability framework, the environmental and regulative circumstances to further deduce entrants' behaviours can be identified. This indicates that entrant firms behave in accordance with their environment. Consequently, entrants in a cross-country comparison would behave according to the different conditions in their home markets.

One major purpose of regulation is to lead to higher customer penetration in a country. Higher penetration rates are the result of a larger customer base and reflect the customers' acceptance. This, in the end, leads to higher domestic demand. In the case of disruptive innovations in particular, entrants are said to play a forward-looking role. They enter into small insecure markets that incumbents don't

pay attention to [8]. But in regulated industries, low domestic demand points to competitive problems, which in the end influence the entrants' chances in a market [4]. This again implies that the forward-looking capability of entrant firms is affected in regulated industries. Hence, entrants have difficulties in these markets because low penetration rates are related to distortions from the competitive environment. Finally, this might have an influence on the behavior of the entering firms. Moreover, the disruptive potential of WLAN technology might be limited, and the utilization of WLAN as public hotspot translates to a sustaining innovation, which would diminish the forward-looking role of entrants [17]. Therefore the first hypothesis can be summed up as follows:

H1: Higher customer penetration rates in the mainstream market, as an indication of stronger competitiveness caused by regulation in a market, have a positive influence on entrant sub-market size as entrants behave consistently with the domestic demand structures.

If the penetration rates are not significant, then entrant firms develop independently from domestic demand. A positive sign of this variable would indicate that entrant firms react to the domestic demand conditions, whereas a negative sign of this variable would reveal that entrants think ahead and enter small sub-markets that are insecure. The last option would also reveal the entrants' independence from regulative efforts. Additionally, a negative sign of this variable would show that entrants have the ability to foresee markets, which they are said to do in a disruptive scenario, whereas a positive sign indicates that they react to given market conditions and avoid entering into emerging sub-markets, which would point to a sustaining scenario.

The motivation/ability framework also suggests that entrants need to be able to access new markets in order to compete successfully. In regulated markets, one of the main barriers is the access to the monopolistic bottlenecks. These may be one part of the network of the former monopolists [9]. If those monopolistic bottlenecks deter entrants from market entry, the purpose of regulation is to minimize these monopolistic bottlenecks, even at the expense of the former monopolists. However, former monopolists have learned to resist regulation and have developed strategies such as lobbying to protect themselves from regulation [29]. If one former monopolist is able to resist regulation in contrast to another in a different country, then the entrants in the first country may have difficulties gaining a foothold in the sub-market. This is visible in the entrants' sub-market size in the former country. Therefore the next hypothesis can be summed up as follows:

H2: A former monopolist's ability to successfully resist regulation has a negative influence on entrant sub-market size, as entrants behave in accordance with the given circumstances.

High incumbents' market shares in a given country represent high barriers to access for entrants and strong

incumbents' resistance to regulation. A negative significance of this variable would indicate that the former monopolists' market share plays a vital role for entrants. If the variable is not significant, this would reveal that the former monopolists' behavior in the accessing does not play a significant role. This last option would further reveal highly competitive markets.

The third purpose of regulation is falling prices. From the market perspective, an incumbent feels strong competition in a market, which is typically the result of many competitors. Low barriers to entry attract many newly entering firms, who try to set the prices below the ones of incumbent firms. This lowers the price to a minimum, which results in low margins for each incumbent. Entrants can now invade the markets; even the threat of entering is thereby sufficient [18]. This indicates that lower prices are connected to strong competition but are only the result of competition. Entrants need a chance to undersell the incumbents' offerings in order to create successful disruptions. The theory of disruptive innovation proclaims that entering firms invade the fringe markets that the incumbents don't fight for because they are not attractive enough by offering low priced products [1]; [2]; [8]. This would indicate that entrants enter into markets where the price of the competing, potentially disrupted product is high. As regulation lowers prices, this factor may also affect the disruptive potential and lead to sustaining innovations. Therefore, regulation can influence the entrants' behaviors and hamper disruption in the end. Entrants would potentially invade the sub-markets where the price-performance ratio is not perfect. However, the structure of network industries allows incumbents to sell their products very cheaply in order to gain market share and the necessary customer base, especially in industries where the additional cost of the product is very small but entry costs are high [26]. This confirms the entrants' chances in markets with high prices, but reveals that disruption may be harder to achieve because of the incumbents' retaliation.

H3: High prices for the competing technology have a positive influence on entrant sub-market size as entrants will have the incentive to undersell this price.

If this variable is significant and positive, this would show that high prices in the mainstream market have a positive influence on entrants and attract more entrants. If the variable was negative and significant, this would indicate that low prices lead to larger sub-market sizes of entrants. If the variable was not significant, then this would reveal that price doesn't have an influence on the entrants' behavior because they behave independently.

III. EMPIRICAL SETTING AND METHODOLOGY

A. The Public WLAN Hotspot Market in the Western European Telecommunications

The telecommunications industry in Western Europe is largely dominated by oligopolistic market structures that

emerged following the deregulation of the former national state telecom monopolist and newly entering firms in the mobile communication service sector, such as Orange, Vodafone, Swisscom, Telekom Deutschland GmbH, or Telefonica [9]; [22]; [21]. The strong need for interoperability and multimedia content implies that network externalities and access to an installed base of users are important [13]. Network effects and strong scale economies due to high fixed costs cause an incumbent to feel a greater loss when losing customers [9]; [26]. Access to telecommunications markets is typically geographically segmented and shaped by government policies [13]. This industry has been and still is subject to various regulation authorities on international (such as the International Telecommunication Union or European Commission) and national levels (such as the Finnish Communications Regulatory Authority or Federal Network Agency). Down to the present day, mobile communication in Europe is predominately enabled by a common technological standard – the second generation (2G) mobile cellular technology for networks: GSM (Global System for Mobile Communications) [22]. The successor – 3G – is based on the GSM standard and called Universal Mobile Telecommunications System (UMTS). UMTS employs wideband code division multiple access (W-CDMA) radio access technology to offer greater spectral efficiency and bandwidth to MNOs than GSM does. UMTS operates in licensed spectrums and mobile operators acquired the licenses during license auctions in 2000-2001, often in connection with high fees [11]. With the acquisition of these licenses, the operators gained the full rights over the spectrum. Additionally, the regulatory authorities have set coverage requirements on the licenses [23]. In this context, High-Speed Downlink Packet Access (HSDPA) represents an enhanced third generation (also labelled 3.5G or 3G+) mobile telephony communications protocol in the High-Speed Packet Access (HSPA) family, which allows networks based on UMTS to have higher data transfer speeds and capacity.

WLAN based on IEEE¹ 802.11 set of standards, on the other hand, operates in the industrial, scientific, and medical (ISM) bands [22]. The advantages of WLAN can be seen in the mostly unlicensed frequencies, which diminish the barriers to entry, high data transmission speeds, and the low costs of deployment (Weil, 2010). Since its advent, WLAN access points and routers have become popular home network commodities and were also recognized as a business opportunity in the form of "hot spots," especially in public places such as stations, hotels, restaurants, etc. [22]. Public WLAN hot spots are used to provide internet access to people without high-bandwidth connections outside of the office or home. Furthermore, other approaches try to deploy WLAN as a substitute for incumbent mobile communications networks [20]; [31]. In these scenarios, large areas, such as cities, are completely covered with WLAN hot zones. These could be complemented by WiMAX (Worldwide Interoperability for

¹ Institute of Electrical and Electronics Engineers.

Microwave Access), which would serve as a backbone technology [11]; [31]. WLAN was typically compared to 3G, which offers a vertically integrated, top-down, service-provider approach to delivering wireless internet access and other services in contrast to WLAN, which offers a more decentralized and end-user-centric approach to service provisioning [22].

As mentioned above, various authors have referred to the disruptive potential of WLAN standards for MNOs [9]; [17]; [20]; [25]; [31]. Most researchers agreed that the threat of disruption in this case was seen in new entrant WLAN operators or WISPs (Wireless Internet Service Provider) providing short-range, high-speed data services in public places enabled by the 802.11b standard, and the unlicensed frequencies in the 2.4GHz band, which could partly bypass the MNOs' data services based on licensed band mobile communication standards such as GSM, GPRS or UMTS. WLAN hotspots are thus a good means for studying sub-market entry behaviour on a multi-country basis because they are built for domestic demand, ensuring that the influence of institutional and regulative factors can be measured.

B. Data Collection and Sample

The data for the analysis contain 104,632 hotspots in 17 Western European countries taken from jiwire and from the incumbents' homepages, of which about 39% belong to incumbents and 61% to entrants. Incumbents are defined as MNOs providing the former, in this case potentially disrupted, technology. These are operators with UMTS (Universal Mobile Telecommunications System) licenses, who already rolled out their networks. Entrants are defined as all other hotspot providers. These can either be MNOs who do not have UMTS licenses at all or do not own UMTS licenses in that specific country. Hence, 62 MNOs were defined as incumbents. The data were collected in 17 Western European countries, namely, Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, the Netherlands, Norway, Portugal, Spain, Sweden, Switzerland, and the UK.

C. Operationalization of Variables

The dependent variable "EntrantsInh" measures the motivation and ability of entrants in the countries. "Ln_EntrantsInh" is calculated using the logarithm of "EntrantsInh." For this reason, the total number of hotspots by entrants has been divided by the total number of inhabitants and multiplied by 100,000 for more convenient results. The data for inhabitants have been taken from the OECD and represent data from 2009.

The following independent variables have been specified for the hypotheses regarding the entrants:

- "BB_subscription" represents a variable that serves as a proxy for the domestic demand on broadband services and, hence, for hotspots as well. This variable thus serves as test of H1. It also shows which markets entrant firms consider entering. The data refer to 2008 and have been

taken from the ITU statistics. Hotspots underlie domestic demand structures because they cannot be traded with. "Ln_BBsubscription" is calculated using the logarithm of "BBsubscription."

- "Exmonshare" represents the former monopolists' market shares in the total broadband access lines. Hence, it serves as a proxy for the former monopolists' resistance to regulation, as suggested by Bonardi, Urbiztondo, & Quélin [3], and their power in this market as well as the access possibilities for entrants into the fixed broadband market. "L_Exmonshare" is calculated using the logarithm of "Exmonshare." The data have been taken from the European Commission and refer to July 2008. Data for Switzerland refer to January 2009 and have been taken from the OFCOM's² annual report. Due to the fact that Norway is not a member of the EU and does not provide any information on the former monopolist market share in terms of the lines in percentage, Norway had to be excluded from further analyses. This variable is used to test H2.
- "Mob_Price" and "BB_Price" each represent the countries' average. These variables serve as independent variables to test H3. The data have been taken from FICORA³ and represent data from the year 2008. The data for mobile telephony represent the small basket of modest mobile phone users who are important when studying a potential disruptive innovation because these prices represent the low demanding customers' costs [1]; [8]. The data for the independent variables refer to 2008.

All independent variables represent environmental factors and it takes time for their changes to take effect on the single firms. We therefore included a one year time lag. In Table 1, we summarize the independent and dependent variables.

D. Model Specification and Tests

To test the hypotheses, a linear regression model was used. Due to the few observations, all model assumptions were tested. The models were tested for heteroscedasticity, non-linearity, collinearity, and normality of the residuals. The significance level for all tests was $\alpha = 0.05$. As all the test results indicated p-values that were higher than $\alpha = 0.05$, none of the model assumptions could be withdrawn. Therefore all models have been proved to be correct, and hence all models can be applied. Additionally all variables have been tested on collinearity, which is not an issue in our analysis.

² OFCOM refers to the Federal Office of Communication of Switzerland.

³ FICORA refers to the Finish Communications Regulatory Authority.

TABLE 1: SUMMARY OF THE DEPENDENT AND INDEPENDENT VARIABLES

Hypotheses	Independent Variables	Dependent Variable
H1	BB_subscription: Domestic demand condition	Ln_EntrantsInh: Entrant sub-market size
H2	L_Exmonshare: Monopolistic Bottleneck	
H3	Mob_Price and BB_Price: Price	

IV. EMPIRICAL RESULTS

A. Descriptive Results

The empirical analysis shows that in 8 of the 17 countries analyzed, incumbents could take advantage of the emerging public WLAN hotspots sub-market. In the other 9 countries, entrants dominate this market. Austria, Belgium, Finland, Italy, Greece, Luxembourg, Norway, Switzerland, and the UK are dominated by entrants whereas Denmark, France, Germany, Ireland, the Netherlands, Portugal, Spain and Sweden are dominated by incumbents. A country is viewed as entrant-dominated if the relative percentage of entrants exceeds 50%, and as incumbent-dominated if the relative percentage of incumbents exceeds 50%. The descriptive analysis reveals that Switzerland, with a market size of 55.08, has created the largest market for entrants, and Greece, with 4.48 entrant hotspots per inhabitants, the smallest market for entrants. Whereas entrants have created huge markets in Switzerland and the UK, entrants in Greece, Italy, and Spain have not. Figure 4 summarizes the developments in the observed countries.

The countries vary in their level of dominance. “ShareInc” represents the total market share of incumbents and “ShareEnt” the market share of entrants in percent, respectively. To calculate the market shares, the total sum of incumbents’ or entrants’ hotspots was divided by the total sum of hotspots in that specific country and multiplied by 100. The results are shown in Figure 5. In the UK, incumbents have 2.85% of the market share, and in Greece,

incumbents have 5.08%. In Denmark, on the other hand, incumbents have 70.65% of the market share and in Ireland, they have 66.15%. Whereas Greece and the UK represent countries of strong entrant domination, Denmark and Ireland are definitely dominated by incumbents. On average, incumbents have a market share of 41.82% whereas for entrants it is 58.18%.

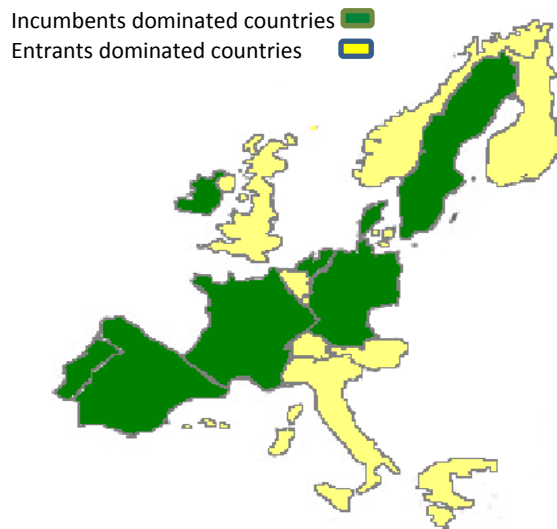


Figure 4: Incumbents’ and entrants’ dominance in the Western European hotspot market

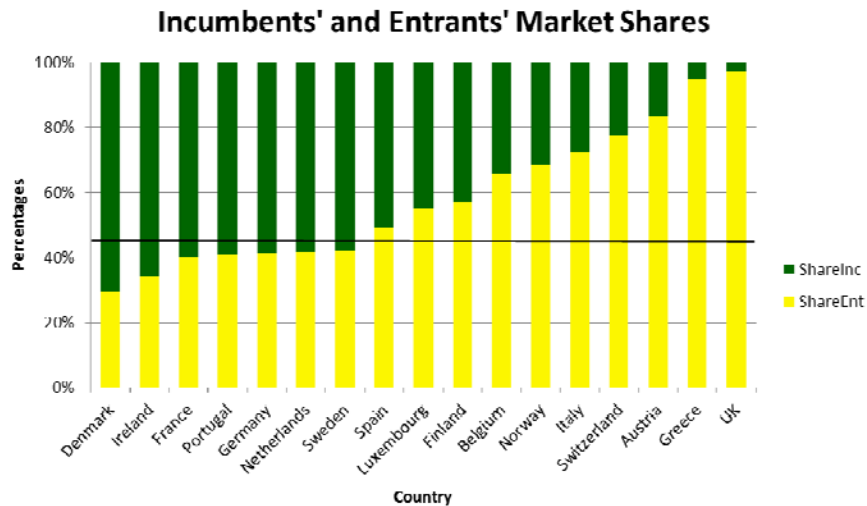


Figure 5: Entrants’ and incumbents’ market shares in the Western European hotspot market

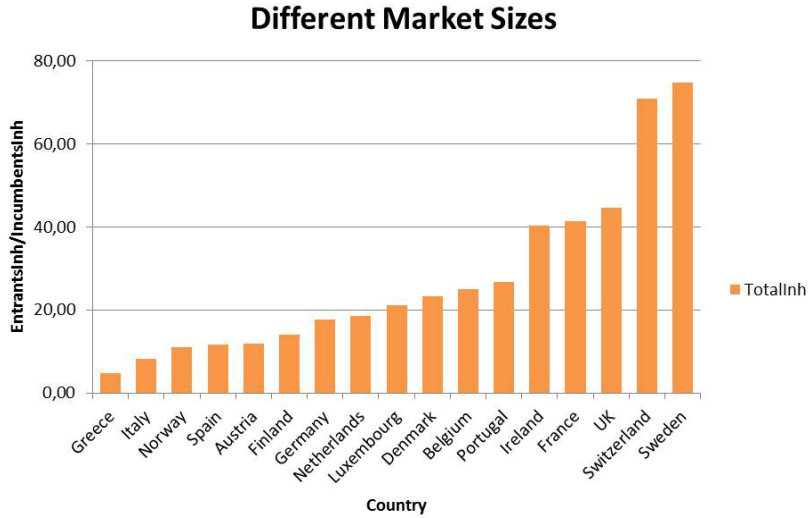


Figure 6: Total market sizes in a cross-country comparison

However, not only do the market shares of the entrants and incumbents differ but also the thereby resulting market sizes. To be able to compare the different market sizes, three new variables have been computed, namely "TotalInh," "IncumbentsInh," and "EntrantsInh". These variables allow for a cross-country comparison of the market sizes.

The result indicates that different market sizes have developed throughout time, as shown in Figure 6. Whereas the largest markets have developed in Sweden and Switzerland, the smallest hotspot markets can be found in Greece and Italy. Additionally, "EntrantInh" and "IncumbentInh" represent the market sizes for entrants or incumbents, respectively, in relation to the total number of inhabitants.

Entrants and incumbents have created different market environments, as shown in Figure 7. The descriptive analysis reveals that Switzerland, with a market size of 55.08, has

created the largest market for entrants and Greece, with 4.48 entrant hotspots per 100,000 inhabitants, the smallest market for entrants. Whereas entrants have created huge markets in Switzerland and the UK, entrants in Greece, Italy and Spain have not. On the other hand, incumbents in Sweden have a market of 43.29 hotspots per 100,000 inhabitants, whereas in Greece they have 0.24 hotspots per 100,000 inhabitants.

B. Results of the Hypothesis Tests

In order to test the hypotheses H1-H3, we used linear regressions. Table 2 shows the results of the linear regressions, which we tested in the models 1 to 3. Model 1 (E) tests H1 and H2, model 2 (E) test H1- H3 and the model 3 (E) tests H1- H3 also. For models 2 and 3 (E) the different variations of the variable specification for H3 have been used, therefore both variables "BB_price" and "Mob_price" were not used in the same model.

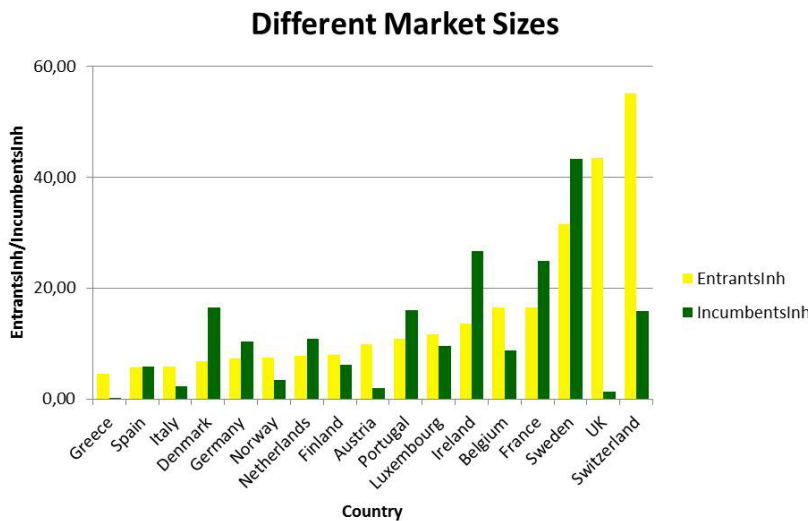


Figure 7: Differences in market sizes for entrants and incumbents

All variables are robust throughout all the model specifications. The results show that “Ln_BBsubscription” is significant throughout all the models, as well as “Exmonshare”/”Ln_Exmonshare.” The results further show that “Ln_BBsubscription” is significant throughout model 1, 2, and 3. As highlighted in model 1, the former monopolists’ market share in the respective market, “Exmonshare”, has a significant negative effect on entrant sub-market size, and ”Ln_Exmonshare” also has a significant negative effect as shown in models 2 and 3. The variable representing the domestic demand “BB_subscription” is robust and significant throughout models 1, 2, and 3. This variable has a positive direction and thus supports the hypothesis H1. The negative and robust variable “Exmonshare” shows that the former monopolists’ market share is a vital and limiting factor for the entrants’ success in the hotspot sub-market, supporting H2. “BB_Price”, as shown in model 2, was not significant, but “Mob_price” (model 3) was significant and had a positive sign as expected. This result indicates that the price only plays a vital role for the entrant market size in the case of the mobile communication service prices, whereas prices of broadband services did not. This shows that high prices increased the market size of entrants and thus only partially supports H3 for the mobile communication service prices.

V. DISCUSSION AND CONCLUSIONS

In previous research in the context of the theory of disruptive innovation, the perspective of the incumbent firms has dominated, and regulation has not been considered on a multi-country basis [6]; [8]; [10]; [9]. In this paper, we focus on the entrants’ perspective, and how regulation affects their motivation and ability to create successful new sub-markets

shaped by a potential disruptive technology in the context of a network industry. In this setting, the impact of potentially disruptive innovations might be different due to the institutional embeddedness of incumbent and entrant firms. Consequently, this paper looked at the entrants in a new sub-market created by a potential disruptive technology such as the WLAN in a cross-country and sector specific analysis in connection with regulation in 17 Western European countries. The entrants’ chances in the public WLAN hotspot market were tested with regard to country-specific regulation such as the possibility of the monopolistic bottleneck, the degree of customer penetration and the prices of the “competing technology.” So far, research has focused on the incumbent entry behavior and did not investigate the factors influencing the entrants in cases of industry changes resulting from potential disruptive technologies. Therefore, the entrants’ possibilities for market success have been analyzed and tested.

The results show that high penetration rates and low control of the former monopolists over the access lead to better chances for the entrants in the Western European hotspot market. In comparison, the role of prices, which, according to Adner [1], are said to be relevant in disruptive circumstances, can be viewed as an inferior influence on entrants’ behaviors when regulation plays an important role in an industry. Although hotspots are projected to have a sustaining impact on incumbents, as Hüsigg, Hipp, and Dowling[17] claim, there are still countries where entrants dominate the markets. This finding reveals that incumbents didn’t use hotspots as sustaining innovation in some of the analyzed countries, although they could have. In these countries, entrants have advanced into the next phase in the

TABLE 2: REGRESSION RESULTS FOR MODELS 1 TO 3⁴

Independent variables	Model 1(E)	Model 2(E)	Model 3(E)
Ln_Bbsubscription	1.0325	1.0437	1.3926
	0.4463**	0.5619*	0.4219***
Exmonshare	-0.0343		
	0.0127**		
Ln_Exmonshare		-1.7034	-1.7001
		0.6305**	0.5000***
BB price		0.0133	
		0.0138	
Mob Price			0.0293
			0.0135*
const	0.8543	5.3289	1.7815
	1.6197	3.0066	2.5215
Observations	16	14	16
R ²	0.507	0.51	0.664
***p-value<0.01			
**p-value<0.05			
*p-value<0.1			

⁴ It has to be emphasized that the decision to take „Exmonshare“ instead of „Ln_Exmonshare“ for Model 1 only results from the model assumption of linearity, which could be withdrawn in case of “Ln_Exmonshare”. The logarithm did not change the interpretation of the results.

innovation process [9]; [15]; [24]. It is noticeable that although hotspots tend to be sustaining for incumbents [17], there are still countries where entrants dominate the markets. This finding supports the “relative” character of disruptive innovations [9]. Therefore, it depends, in the end, on the individual markets and the country-specific regulation as to whether a technology can be seen as sustaining or not. The disruptive theory predicts that an incumbent will be less willing to enter into disruptive markets because of the “failure framework” [8]. The overall results further indicate that if the regulative environment does not offer the right possibilities for entrants to innovate, the resulting sub-market sizes will be small. Hence entrants will create small sub-markets only. According to Christensen, Anthony, and Roth [9], this is the situation that can be viewed as the “dilemma” situation. In contrast, if entrants get the right possibilities, then relatively large sub-markets will develop, and entrants will be able to proceed further to the next stage in the disruption process. Anthony, Roth, and Christensen [2] call these markets “hotbed” or “panacea” situations.

Moreover, our results show that the entrants’ behaviors in the hotspot market underlie domestic demand structures. This means that hotspots are only built for home market purposes, and, hence, entering firms could behave in accordance with the institutional settings. Other innovations may lead to different outcomes because they may be produced for other countries, which may lead to distorted results. The results indicate that an entrants’ cumulative behavior is consistent with the environment where they operate. This means that entrants and their sub-market success could be predicted. In environments where entrants had difficulties entering or finding suitable markets, entrants collectively shied away from market entry, and the resulting market sizes aren’t large. After 10 years of WLAN and years of regulation, the former monopolists’ market share still plays a vital role for entrants. The domestic demand plays a supporting role for entrants. This implies that entrants react to certain circumstances instead of anticipating. Entrants entered into those markets with relatively high demand and large mainstream markets. Consequently, entrants, in this case, avoided small and uncertain markets. They entered into markets that already promised to be successful. This would suggest that WLAN hotspots have been a sustaining technology or contradict the disruption theory [8]; [17]. Another possible explanation for this divergent behavior could also be rooted in the effect of regulation that impedes market entry. Interestingly, the relative mobile broadband prices were not significant in contrast to the mobile phone service prices. The price, however, had a positive but not significant influence on the entrants’ market size, which points to the fact that entrants can create successful markets where they have the chance to underbid incumbents, especially in the case of the mobile communication services.

These findings have several interesting policy and strategy implications since many regulative comparisons concentrate

on prices, which would reveal the competitiveness of the market. But the above results show that the former monopolists’ power over the relevant network still plays a vital role for entering firms. For them, this factor seems to be more relevant than price. The latter only plays a role in a broader context with many other factors. Therefore, it would be more appropriate to concentrate on the input factors of regulation, like the former monopolists’ might of a bottleneck, instead of the prospective output factors of competition. This may be difficult to pursue because the extent of “power” is hard to measure. But only this truly reveals the true bottlenecks of competition in a market. One possibility could be structural separation. This, in the end, is one of the most radical market interventions, but also the most effective as this would take away the former monopolists’ power over the networks. National and supra-national policy makers who try to foster entrepreneurship should consider this option.

In this case, the analyzed market might be predominately sustaining, but these results can also be applied to disruptive innovations. Our findings reveal that knowledge about emerging technologies, as well as incumbents’ strategies to enter such emerging sub-markets at the right time, are not enough. This timing of the incumbent’s entry could be a result of them having become more sensitive about underperforming, potentially disruptive innovations, i.e. they have gained the “disruptive black belt” [9]. It also sheds light on the entrant perspective in markets where network effects and regulation play also a major role in technological transitions.

The latest developments in the mobile broadband market with HSDPA and the launch of LTE (Long Term Evolution) reveal new fields for further research about the future of public hotspots. During the time of the empirical results, HSDPA rollouts were not yet completed. The influence on entering firms’ hotspots could be observed over a longer period of time. Furthermore, the analysis does not include whether incumbents built a separate organization for hotspots or whether they integrated it into their main organization, which represents a limitation due to the character of an industry level study. The structural and strategic choices on the individual firm level in the case of WLAN hotspots should be a subject for future research.

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